Arthroscopic Hemitrapeziectomy for First Carpometacarpal Arthritis: Results at 7-year Follow-up

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Abstract The purpose of this study was to determine the outcome of arthroscopic hemitrapeziectomy combined with thermal capsular plication and temporary K-wire fixation in patients with painful thumb basal joint due to either osteoarthritis or posttraumatic arthritis. There were 18 thumbs that were evaluated in this retrospective study of arthroscopic hemitrapeziectomy of the distal trapezium in addition to a pancapsular thermal shrinkage at an average of 7.6-year follow-up. No patient has required further surgery. A subjective improvement in pain, pinch activities, strength, and range of motion (ROM) was noted in all patients, and no patient had further surgery on their thumb. On exam, no patient had a first carpal–metacarpal grind or laxity. Total ROM of the thumb axis decreased by 20%, but all patients could oppose to the fifth finger. Grip strength remained unchanged, key pinch improved from 8 to 11 lbs, and tip pinch improved from 4 to 5 lbs. Radiographs

showed a metacarpal subsidence of 1.8 mm (0–4 mm). Four complications were noted: two cases of dorsal radial nerve neuritis, one rupture of the flexor pollicis longus, and one prolonged hematoma. Results demonstrate that arthroscopic hemitrapeziectomy and capsular shrinkage for first carpometacarpal arthritis is an effective technique that provides high patient satisfaction, a functional pain-free thumb, and a reliable rate of return to activity.

Keywords Arthroscopy · Thumb · Arthritis ·
Thumb carpometacarpal joint · Basal joint · Trapeziectomy

Introduction

First carpometacarpal (CMC) arthritis is one of the most common arthrosis of the upper extremity. Typical nonoperative treatment of this condition consists of splinting, activity modification, nonsteroidal antiinflammatory medication, and injections. Various surgical options have been proposed, including excisional arthroplasty of the trapezium [12], which has been shown to be highly successful in relieving the pain but is inconsistent in restoring thumb strength and stability [17]. Swanson [28] encouraged the use of a silastic spacer, but this has fallen out of favor due to silicone-related complications. One of the most common surgical treatment options currently used is trapezium excision combined with a ligament reconstruction and tendon interposition (LRTI) popularized by Burton and Pellegrini [7].

In an effort to maintain the osseous foundation of the base of the thumb, conservative joint resection and trapezium-retaining interposition arthroplasty has been described [5, 19, 21]. These procedures have been met with varying degrees of success.

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Arthroscopy of the thumb CMC joint has been utilized for synovectomy, removal of loose bodies, treatment of thumb CMC arthritis, and in assistance with fracture reduction and fixation [6, 20, 31]. The role of small joint arthroscopy for first CMC arthrosis continues to adapt and indications have yet to be defined. There have been several studies with short follow-up periods reported [2, 3, 9, 11]. Our hypothesis is that resection of the distal trapezium combined with thermal capsular plication and temporary K-wire fixation for support, done with the aid of arthroscopy and fluoroscopy, would minimize the complications associated with more invasive procedures, yet yield high patient satisfaction several years after the procedure.

Methods and Materials

Over a 2-year period, 18 thumbs in patients with basal joint arthritis were treated with arthroscopic synovectomy and resection of the distal one half of the trapezium combined with thermal capsular plication. Fourteen patients had temporary K-wire fixation of the first CMC joint (initially based on senior surgeon preference, but evolved to all patients having portion of the procedure done). The cohort consisted of 14 women and four men, and the average age at time of surgery was 48 years old (range 38–56 years old). The diagnosis was osteoarthritis in all but four patients wherein the etiology was post traumatic from previous fractures. Except for a closed reduction and pinning in patients where the fracture occurred several years previous to presentation, no prior procedures had been performed.

Preoperative symptoms were present for an average of 21.3 months (range 6–72 months), and no patient had any clinical evidence of radial sensory nerve irritation. All patients failed conservative treatment with activity modification, nonsteroidal antiinflammatories, splints, and injections. On physical exam, all patients exhibited tenderness to palpation at the first CMC joint with a painful grind when stressed. Thumb range of motion (ROM) consisting of flexion, extension, abduction, and adduction was measured preoperatively and postoperatively. Radiographically, two patients presented with Eaton stage I first CMC arthritis, 14 with stage II, and six with stage III arthritis. Postoperatively, all patients were followed routinely and all complications were recorded; 3 months postoperative radiographs and a subjective “thumb function score” questionnaire were collected at their most recent follow-up. This questionnaire rated equally pain, strength, resumption of activities of daily living, and ROM (range from zero the worst to 100 maximum score).

Strength was documented by measuring grip strength with a dynamometer (Jamar; Asimov Engineering, Los Angeles, CA, USA), key pinch, and tip pinch (Therapeutic

Instruments, Clifton, NJ, USA) before and after surgery. Composite ROM of the thumb axis (combined flexion, extension, abduction, and adduction) was also recorded preoperatively and postoperatively. A Wilcoxon signed rank test was utilized to compare preoperative to postoperative data.

Procedure

Under general anesthesia or axillary arm block, the extremity was prepped and suspended in 8 lbs of thumb traction. The first extensor compartment was identified at the level of CMC joint, and the one-radial (1-R) portal, which is volar to the abductor pollicis, was localized. Just ulnar to the extensor pollicis brevis tendon, the one-ulnar (1-U) portal was marked. The joint was distended with 2 cc of saline, and two superficial incisions were made over the joint in a longitudinal fashion. Blunt dissection with small hemostats dilated the portals, and the trocar was inserted with care given to prevent injury to the superficial radial sensory nerve, dorsal radial artery, or tendons. A 1.9-mm arthroscope with inflow was inserted in the 1-R portal, and the 1-U working portal was established (Fig. 1), and a diagnostic arthroscopy completed [2, 3, 6, 9, 11, 31].

Upon completion of the diagnostic arthroscopy, a 2.0-mm shaver was utilized to perform the synovectomy and to remove any loose bodies (Fig. 2) or redundant capsule. The distal half of the trapezium was excised using a 2.9-mm burr and utilizing fluoroscopy to determine the amount of resection. A 0.045 K-wire was used for fixation across the joint, and use of a thermal capsular shrinkage probe was applied to the superficial and deep anterior oblique

Figure 1 Basic initial first CMC set-up, utilizing the 1-R portal for the 1.9-mm arthroscope and the 1-U portal for the “working portal.”

Figure 2 Arthroscopic view of a 2.9-mm burr used to remove a loose body (LB). Note the extensive eburnation of the trapezium (CM).

ligament (AOL), ulnar collateral ligament, posterior oblique ligament, dorsal radial ligament, and capsule as described by Edwards et al. [11]. Fluoroscopy was used to confirm adequate resection and to confirm K-wire placement if performed (Fig. 3). The two portals were closed with simple sutures, and a short arm thumb pica splint was applied. Postoperatively, the sutures were removed at approximately 1 week, and a short arm cast was applied for 3 weeks, at which time the percutaneous pin was removed. Formal occupational therapy was started, and a removable splint was worn for an additional 4 weeks.

Results

At an average of a 7.6-year follow-up (range 6.5–8.4 years), no patient required or desired further surgery on the thumb. Seven patients elected to have an arthroscopic hemitrapeziectomy and capsular shrinkage for first CMC arthritis on their contralateral thumbs which are excluded from this study.

Utilizing a “thumb function score,” a significant improvement was observed with scores improving from 60 to 90. The average return to work was 5.2 weeks as most of the patients were not heavy laborers. On physical examination, three patients had mildly positive CMC grind tests and one patient had asymptomatic laxity of the CMC joint. Composite ROM of the thumb axis decreased by 20%, but all patients could oppose to the fifth finger. Postoperative grip strength did not change, remaining at 55 lbs; however, key pinch improved from 8 to 11 lbs ($p<0.001$) and tip pinch improved from 4 to 5 lbs ($p=0.001$).

Preoperative radiographs, intraoperative fluoroscopy, and 3 months postoperative radiographs were compared. In all cases, approximately 50% of the distal trapezium was

resected, and this resected space decreased by 1.8 mm (0–4 mm) over the 3 months. There were no cases of radiographic metacarpal subluxation. Follow-up radiographs from the last visit were compared to the immediate postoperative fluoroscopy, and there was subsidence of 1.8 mm (0–4 mm) of metacarpal shaft proximally.

There were four complications: two cases involved dorsal radial nerve neuritis of which one was persistent, one patient had a prolonged hematoma and superficial skin necrosis that resolved, and one patient sustained a rupture of her flexor pollicis longus (FPL) 6 weeks after surgery. All complications were treated nonoperatively, except for the rupture, which required primary repair and did extremely well postoperatively. At the time of exploration of her FPL, the rupture was identified occurring at the level of the trapezium resection and was amenable to primary repair.

Discussion

Treatment of arthritis of the thumb CMC joint has been extensively described in the literature. Burton and Pellegrini [7] have set the gold standard of treatment in a landmark description of their version of the LRTI procedure. Long-term results of this technique were reported in 1995 and showed 95% excellent results at an average of 9 years follow-up [29]. The authors did acknowledge an average loss of 11% of the radiographic postsurgical space after arthroplasty. Lins et al. [18] reported uniformly satisfactory

Figure 3 Fluoroscopic image of the resected trapezium stabilized with a K-wire.

subjective and objective results following tendon interposition arthroplasty even though the ligament failed to consistently maintain trapezium height on radiographs. Rayan and Young [23] reported 97% good and excellent results at 38 months with 27% proximal migration of the thumb metacarpal. This procedure and concept has been modified by many different researchers with varying degrees of success—suspensionplasty with abductor pollicis longus [26], extensor carpi radialis brevis [15], and hemitrapeziectomy with interposition. Arthrodesis of the thumb CMC joint has been advocated [14] but is generally reserved for younger, more active patients.

A less invasive approach has been sought for younger patients and those with less severe disease radiographically; these patients often prefer a procedure with a quicker recovery period and one that is less invasive and less painful. The use of small joint arthroscopy in the smaller joints of the hand has been discussed by Watanabe [32] and has been refined over the years by other authors [8, 24, 30].

Menon [20] described the treatment of thumb CMC arthritis with partial resection of the trapezium through a small joint arthroscope with tendon interposition in 1996; his report included 33 partial arthroscopic interposition arthroplasties utilizing palmaris longus, flexor carpi radialis, gortex, or fascia lata allograft. The results at 24–48 months follow-up showed complete pain relief in 25 patients; three patients had mild pain and four had persistent pain requiring a second operation.

In 1997, Berger et al. [6] reported on 12 CMC arthroscopies: four for Bennett's fractures, seven for CMC debridements in early CMC arthrosis, and one as a staging procedure. The authors noted no complications and emphasized the importance of knowing the local anatomy of the radial artery and branches of the superficial radial nerve.

In our description of the procedure for arthroscopic treatment for CMC arthritis, we performed a thermal capsular shrinkage of the superficial and deep AOL ligament, ulnar collateral ligament, posterior oblique ligament, dorsal radial ligament, and capsule combined with hemitrapeziectomy. The theoretical basis for its use is that the early pathology in thumb CMC arthritis involves instability created by the lax AOL [13, 16]. The importance of the integrity of this ligament in maintaining CMC stability has been emphasized in many studies [13, 16, 22]. We also believe that the procedure may have the added benefit of a partial neurectomy of the treated capsule and soft tissue by destroying the afferent sensory receptors, assisting in pain relief; however, this is theoretical and has yet to be proven [11].

Although many studies have reported use of thermal capsular shrinkage in the shoulder—and recent criticism

due to overuse and potential complications are described [1, 27], few have reviewed its use in the hand and wrist [4, 10, 25]. Although it may be possible to obtain better results in the hand and wrist due to their small size of the joint, different kinematics, and lack of load bearing characteristics, this has not been shown in the literature and thermal capsular shrinkage may lead to damage of the articular surface, superficial nerves, or tendons.

It should be noted that this procedure should be done by experienced arthroscopist with the use of fluoroscopy. This procedure cannot be used in all patients, and patients must be carefully assessed preoperatively. Significant or symptomatic pantrapezial arthritis is a contraindication, as is concomitant scaphotrapezial arthrosis. Another difficulty is visualizing the far ulnar arthrosis at the base of the second metacarpal. Also, this procedure does not address the metacarpal–phalangeal joint, particularly if hyperextension is a problem. In addition, a careful technique and understanding of the local anatomy is important, as two of our patients had complications related to their superficial radial nerve; therefore, the process is not advisable in patients who have had previous injury or neuritis of their superficial radial nerve. Also, it is likely that the FPL rupture was secondary to thermal damage or possibly K-wire penetration, although this cannot be proven and pathologic analysis of the debrided tendon at time of surgery showed no abnormal thermal degeneration.

In our study, we provide data on the long-term (7.6 years) follow-up of 18 patients who underwent an arthroscopic procedure on their thumb, none of them have required a revision surgery; their thumb function scores increased, and an early return to work was obtained. Their grip strength stayed the same, and their tip and key pinch strength improved slightly. This procedure is a good option for early utilization, as it leaves “no bridges burned.” It is minimally invasive and has minimal morbidity, immobilization, and recovery time, yet yields high patient satisfaction and early return to work.

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